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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/577,542

04/28/2006

Edward J. Anthony

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07/22/2008

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EXAMINER

LIAO, DIANA J

ART UNIT

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/577,542	<b>Applicant(s)</b> ANTHONY ET AL.	
	<b>Examiner</b> DIANA J. LIAO	<b>Art Unit</b> 1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |                                                                                        |                                                                   |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. ____.                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>4/28/2006, 3/27/2008</u> .                                    | 6) <input type="checkbox"/> Other: ____.                          |

## **DETAILED ACTION**

### ***Information Disclosure Statement***

1. The information disclosure statement (IDS) submitted on 4/28/2006 and 3/27/2006 are in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

### ***Status of Application***

2. Claims 1-18 are presented for examination.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1 and 8 are found indefinite due to lack of clarity and lack of antecedent basis.

The preamble of the claim recites "A method of *increasing* the carbon dioxide-capture capacity of an alkaline earth metal *sorbent in the fluidized bed...*" (emphasis added). Regarding the term "increasing," there is no reference point in the claim to define and compare how the capacity is increased. Regarding the term "sorbent," a sorbent is not mentioned anywhere in the main body of the claim nor is the sorbent

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defined in the claim. Regarding “the fluidized bed”, it is unclear whether it is a positive limitation in the claim as the method is for increasing the capture capacity of a sorbent and the fluidized bed is not mentioned anywhere else in the claim and does not appear to be essential. In addition, if the fluidized bed is a positive limitation, then it is unclear whether it is the *method* that is performed in the fluidized bed or if it is the *sorbent* which will have increased capacity when used in a fluidized bed.

Claims 3 and 9 recite the limitation “spent sorbent” and “uncaptured carbon dioxide” in the middle of the claim. There is insufficient antecedent basis for this limitation in the claim. The source of the spent sorbent or for the uncaptured carbon dioxide is not specified. “Sorbent” is only mentioned in the preamble, which was found to be indefinite. “Uncaptured carbon dioxide” also needs further definition since it can come from any step in the process and there is no mention of “captured carbon dioxide” in the claims.

Claims 6, 7, 17 and 18 are found to be indefinite because they are based in the preamble of claim 1, and not in any of the positively defined claimed process steps.

Remaining claims are found indefinite for being dependent on indefinite claims.

### ***Claim Rejections - 35 USC § 102 and 103***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 1, 2, 4 and 5 are rejected under 35 U.S.C. 102(b) as being anticipated by Shimizu, et al. ("A Twin Fluid-Bed Reactor for Removal of CO<sub>2</sub> From Combustion Processes", 1999).

Shimizu, et al. teaches a process for CO<sub>2</sub> removal using calcium oxide. The process uses two fluidized bed reactors, one absorber and one regenerator. CaO captures CO<sub>2</sub> in the absorber to form CaCO<sub>3</sub>, which is then transported to the regenerator to recover CaO. The CaO recovered is recycled back into the absorber, creating a cyclic process. The flue gas from the regenerator is high purity CO<sub>2</sub> of greater than 95% on a dry base. The calcium carbonate is calcined at 1223K (or 950°C) in the regenerator, equivalent to claimed calcining step. (see abstract and figure 1)

The air stream entering the absorber contains about 15% CO<sub>2</sub> (as calculated from the values in Fig 1), while atmospheric air is known to contain about 0.04% CO<sub>2</sub>. Therefore, the gas stream entering the absorber is considered to have a presence of concentrated CO<sub>2</sub>.

The limitation of the carbon dioxide produced being pure carbon dioxide is found to be met, since the term carbon dioxide should inherently be pure carbon dioxide. In addition, since the term "pure" is not clearly defined, and Shimizu, et al. discloses a high purity CO<sub>2</sub> along with all of the process steps as required by instant claim 1, then the purity of the CO<sub>2</sub> produced must be acceptable and identical to that of the claimed invention.

Regarding the use of lime and carbonating to create limestone, this is considered to be inherent or obvious in view of Shimizu, et al. Lime and limestone are generally accepted to be represented by the formulas CaO and CaCO<sub>3</sub> respectively. Thus exchanging the two terms would not appear to define a different process.

Therefore, claim 1, 2, 4 and 5 are not found patentable over the prior art.

9. Claims 1-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimizu, et al. in view of Gupta, et al. ("Carbonation-Calcination Cycle..." 2002) and Anthony, et al. ("Pacification of high calcic residues..." 2000).

Shimizu, et al. teaches the limitations of the instant claims as discussed above.

Shimizu, et al. does not refer to the carbon dioxide containing stream entering the absorber as "concentrated carbon dioxide", despite teaching a concentration higher

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than that of atmospheric air. Shimizu, et al. does not specifically teach a portion of the process where spent sorbent and uncaptured carbon dioxide is recovered. Shimizu, et al. also does not teach the use of either a pressurized fluidized bed combustor (PFBC/C) or a circulating fluidized bed combustor (CFBC/C). However, as explained below, they are found obvious in view of Shimizu, et al.

Regarding the use of “concentrated carbon dioxide,” it would have been obvious to use a concentrated stream even higher than that taught in Shimizu, et al. due to optimization. It would have been obvious to optimize the amount of carbon dioxide in the atmosphere with the alkaline earth oxide in order to optimize the amount of carbonation, which is the primary function of the reaction.

Regarding terminology of lime and limestone, in the event that lime and limestone have a different meaning than  $\text{CaO}$  and  $\text{CaCO}_3$  as recited by Shimizu, et al., it would have been obvious to use lime and limestone since they are naturally found abundant minerals which can capture  $\text{CO}_2$ .

Regarding the recovery of uncaptured carbon dioxide and spent sorbent, it would have been obvious to recover any materials in an industrial process. Releasing excess greenhouse gases such as carbon dioxide would be environmentally undesirable. The carbon dioxide and the gas stream in general would have to be recovered for further processing. The spent sorbent would also need to be recovered or regenerated before disposal.

Regarding the type of fluidized beds employed, they are found obvious in view of Shimizu, et al. Shimizu, et al. generically teaches fluidized beds, and fairly teaches the

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species of pressurized or circulating fluidized beds. Pressurized fluidized beds are known in the art for their added advantage of high pressure exhaust gasses or steam which may be used for turbines. Circulating fluidized beds have the advantage of reintroducing particles back into the main reactor several times which is advantageous because the process is overall more efficient by cycling the particles through the reactor to reach full conversion.

Regarding claims 8-18, Shimizu, et al. does not teach an intermediary step of converting an alkaline oxide into a hydroxide before carbonation.

Gupta, et al. teaches a cyclical carbonation-calcination process for use in separating CO<sub>2</sub> from flue gas streams. A wet precipitation process is used to create precipitated calcium carbonate (PCC) which is less susceptible to pore plugging and maintains high reactivity after a few cycles. (abstract) PCC is shown to achieve higher conversion than CaO of other origins. (Figure 7) The PCC is synthesized by carbonating hydrated lime, Ca(OH)<sub>2</sub>. (pg 4037)

Regarding the creation of an alkaline earth hydroxide, Gupta, et al. teaches that the eventual CaO product from PCC, created from a hydroxide, shows better CO<sub>2</sub> sequestering performance over time and has higher conversion. Although Gupta, et al. does not teach the method of making the Ca(OH)<sub>2</sub>, mixing CaO with water as in the instant claims is a well known method of making Ca(OH)<sub>2</sub>, as the name "hydrated lime" implies. One would have been motivated to create the CaO to be used as a sorbent



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through wet precipitation to achieve the higher surface area and better conversion in the CO<sub>2</sub> capture process.

Shimizu, et al. further does not teach the conditions of hydrating the oxide to create the alkaline earth hydroxide, specifically a temperature greater than 50°C .

Given the use of a hydroxide to make PCC as taught by Gupta, et al., Anthony, et al. is presented to suggest conditions for the creation of the hydroxide.

Anthony, et al. teaches that CaO converts to Ca(OH)<sub>2</sub> at temperatures above 100°C. The CERCHAR process for hydration was created in order to address the exothermic nature of hydration of lime. In the CERCHAR process the solids are wetted at atmospheric temperature and as more water is added, the pressure then rises to 1MPa, which is roughly 10 times atmospheric pressure. (pg 2, section 1.1)

Regarding temperature and pressure, Anthony, et al. teaches that CaO conversion to Ca(OH)<sub>2</sub> occurs above 50°C, and the pressure can vary from atmospheric to high pressure during the process, thus encompassing the claimed pressure ranges. One would be motivated to employ these conditions since they allow hydration to occur, and the CERCHAR process was made to deal with the exothermic nature of hydration.

Therefore, due to the addition of steps to create a CaO sorbent through a hydroxide is found to be obvious as taught by Gupta, et al. in order to create a more desirable surface area, the conditions for hydration are found obvious per the teachings of Anthony, et al. as to how to achieve hydration, substitutions of alternatives and

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environmental motivations, claims 1-18 have not been found patentable over the prior art.

### ***Double Patenting***

10. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1-18 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 10-20 of copending Application No. 10/577540. Although the conflicting claims are not identical, they are not patentably distinct from each other. Claims 1-7 of the instant application are anticipated by claims 10-20 of the copending Application '540, which contain extra steps which are not excluded by the scope of the claims. Claims 8-18 appear to only differ in regards to the preamble, with all positive process limitations being identical.

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This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

### ***Conclusion***

Claims 1-18 have been rejected. No claims have been allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DIANA J. LIAO whose telephone number is (571)270-3592. The examiner can normally be reached on Monday - Friday 8:00am to 5:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 571-272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ngoc-Yen M. Nguyen/  
Primary Examiner, Art Unit 1793

DJL